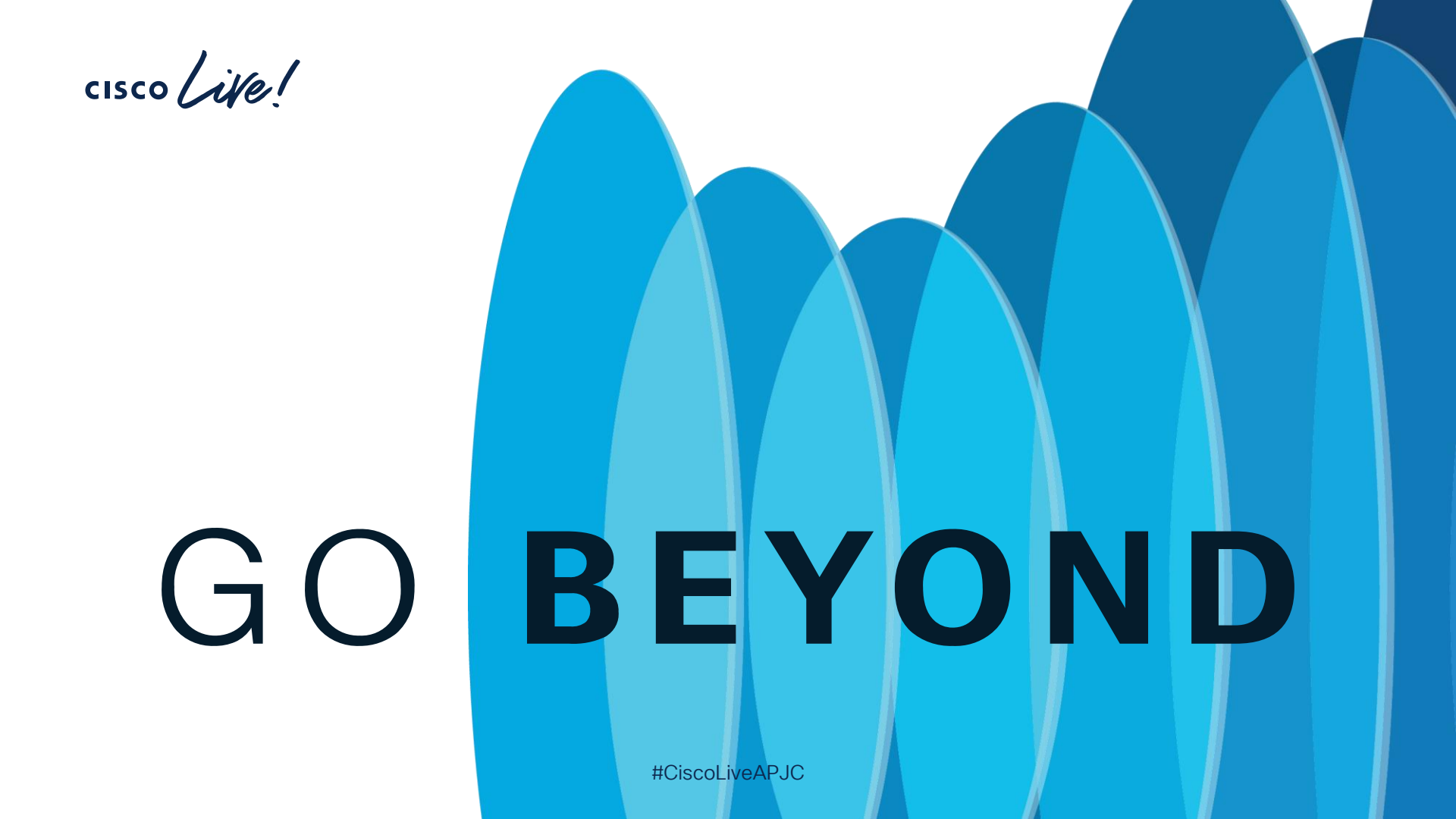

cisco Live!
GO BEYOND
#CiscoLiveAPJC

Introduction to SRv6 uSID Technology

Jakub Horn
Principal Technical Marketing Engineer
BRKMPL-2203

Cisco Webex App

https://ciscolive.ciscoevents.com/ciscolivebot/#BRKMPL-2203

Questions?

Use Cisco Webex App to chat with the speaker after the session

How

1. Find this session in the Cisco Live Mobile App
2. Click “Join the Discussion”
3. Install the Webex App or go directly to the Webex space
4. Enter messages/questions in the Webex space

Webex spaces will be moderated by the speaker until November 15, 2024.

cisco Live!

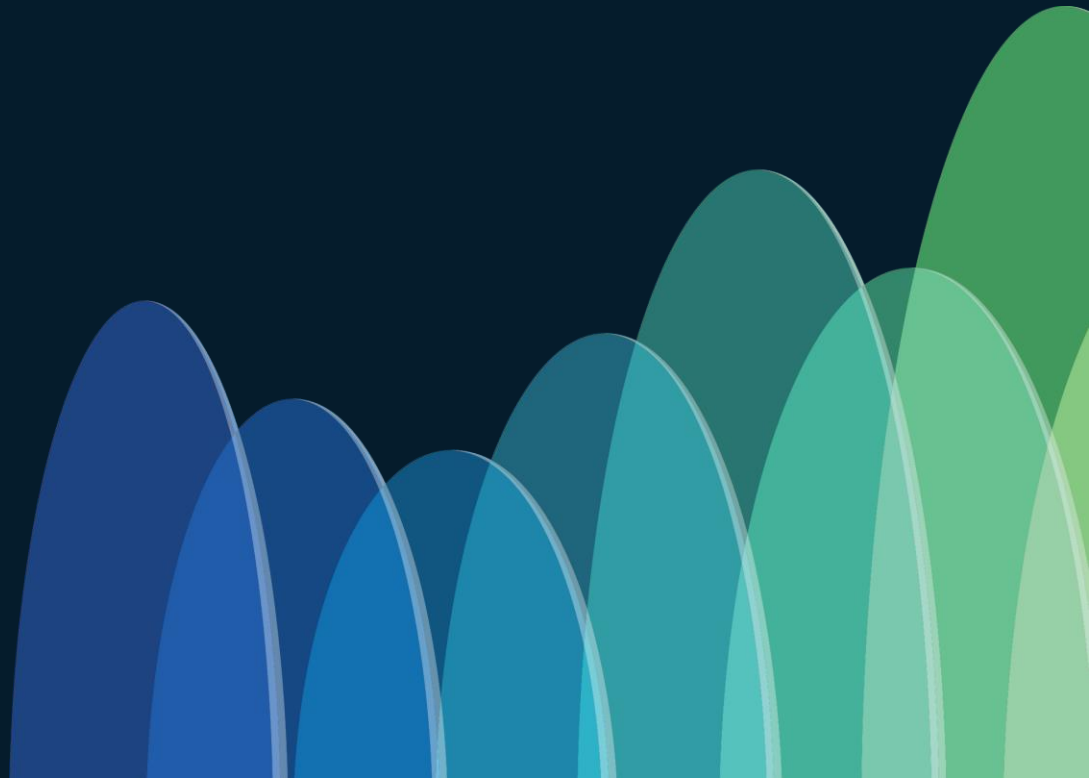
© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public

Agenda

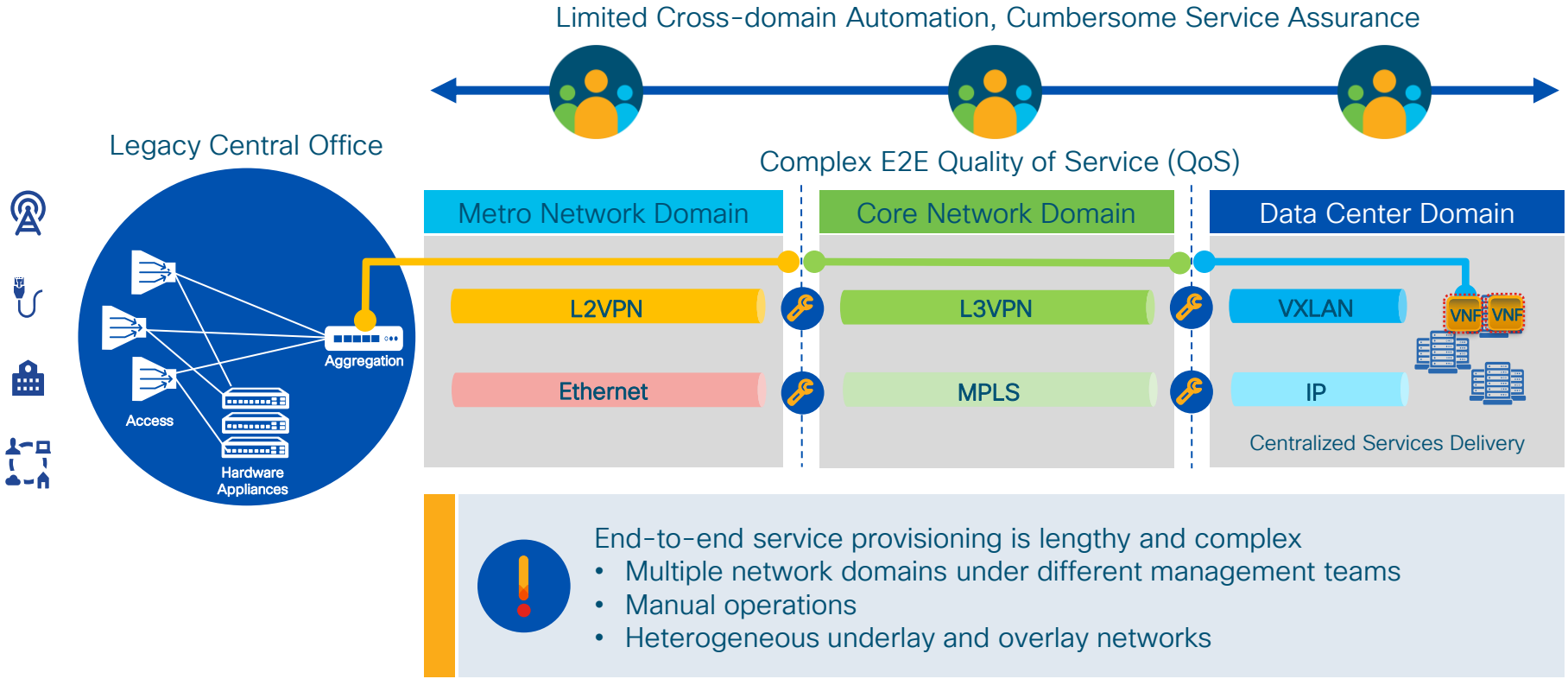
- Introduction
- SRv6 uSID Dataplane
- SRv6 uSID Network Programming
- ISIS with SRv6
- BGP with SRv6
- Conclusion

© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

Introduction



Understanding today's service creation

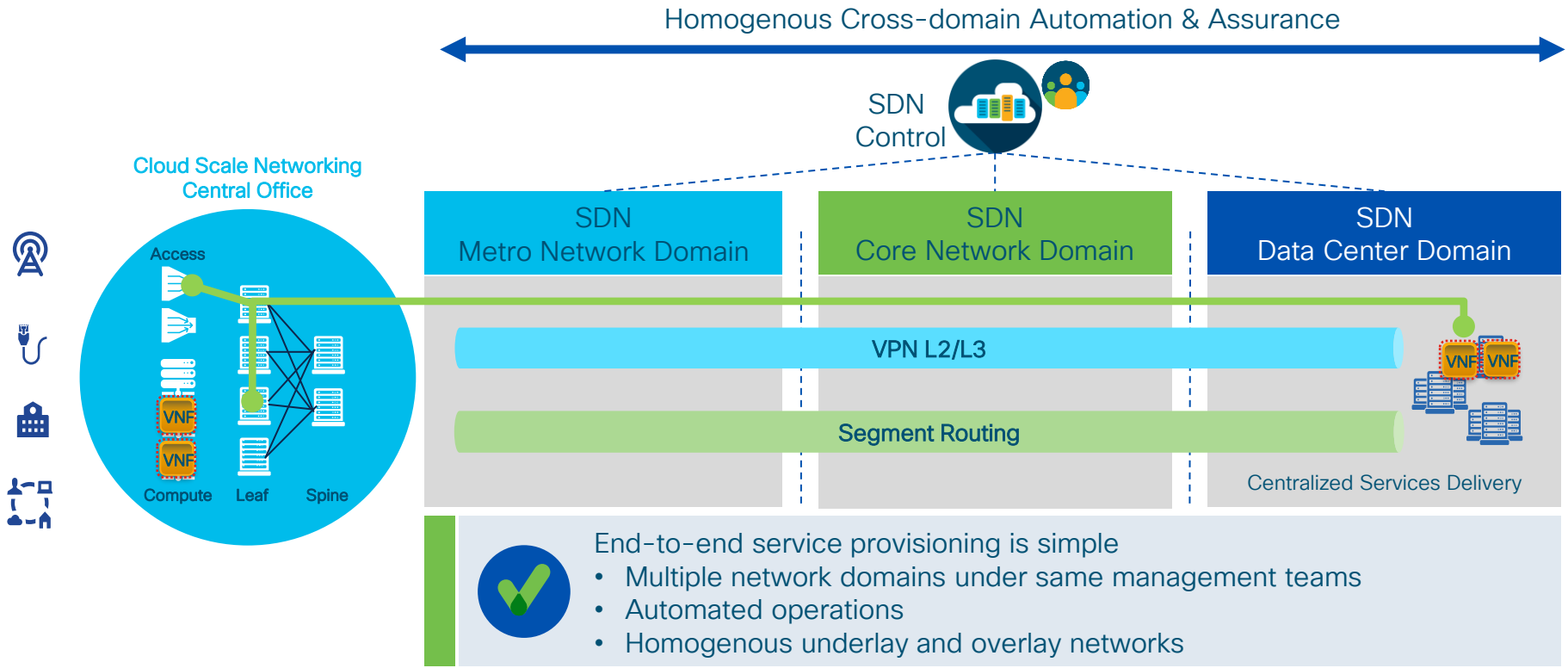


End-to-end service provisioning is lengthy and complex

- Multiple network domains under different management teams
- Manual operations
- Heterogeneous underlay and overlay networks

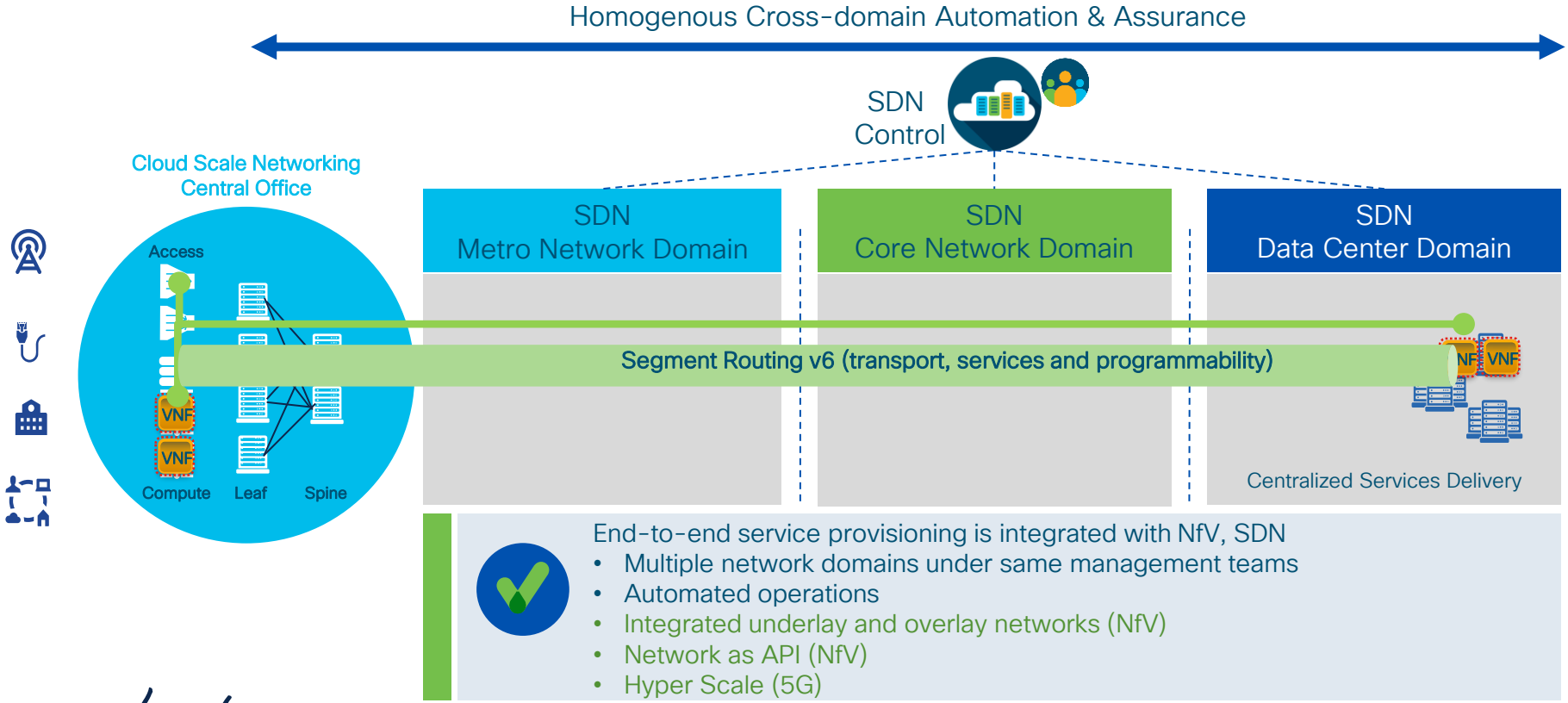
© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

SR-MPLS: SDN ready
“Network as a Fabric” for service creation



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

SRv6: SDN, NfV, 5G ready
“Network as an API” for service creation

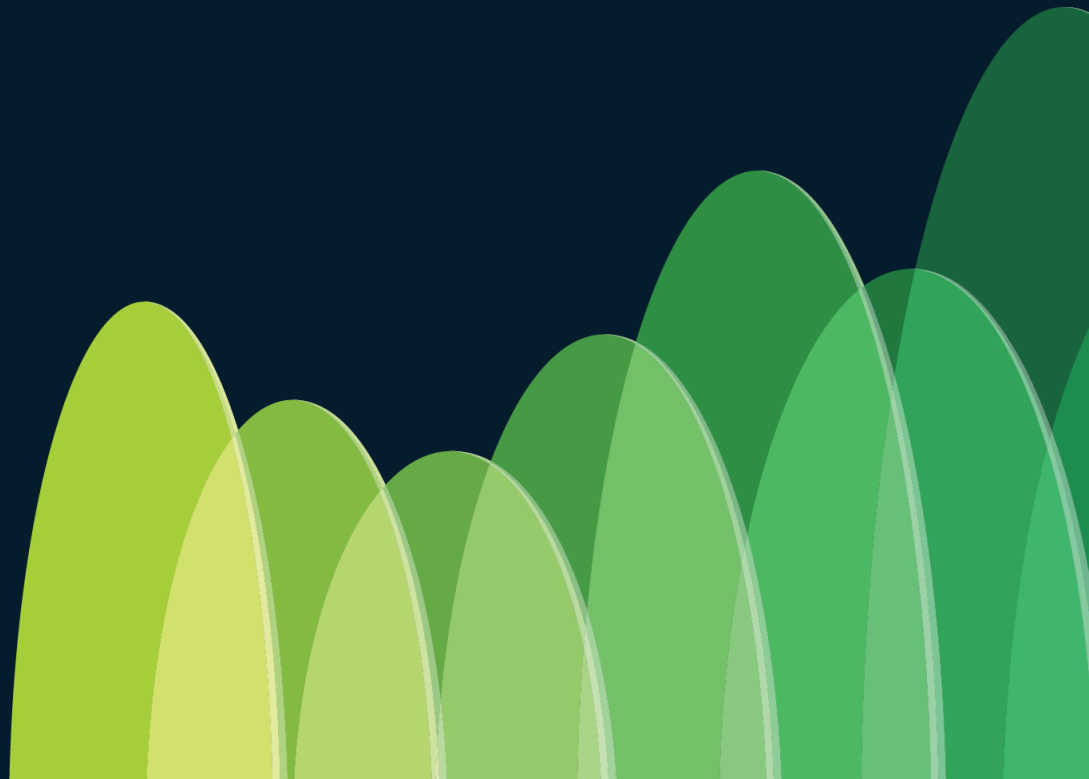


End-to-end service provisioning is integrated with NfV, SDN

- Multiple network domains under same management teams
- Automated operations
- Integrated underlay and overlay networks (NfV)
- Network as API (NfV)
- Hyper Scale (5G)

© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

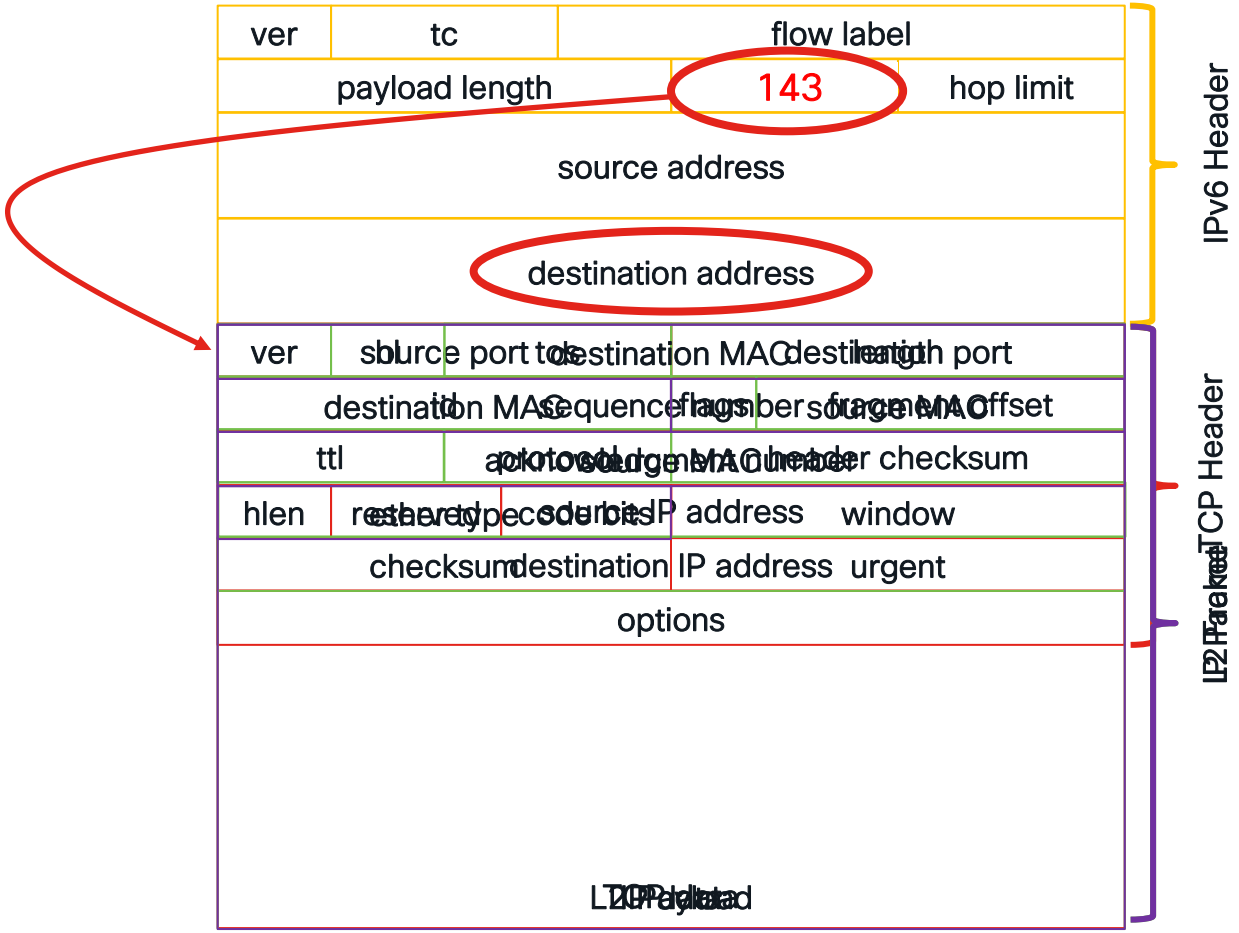
SRv6 uSID Dataplane



cisco Live!

SRv6

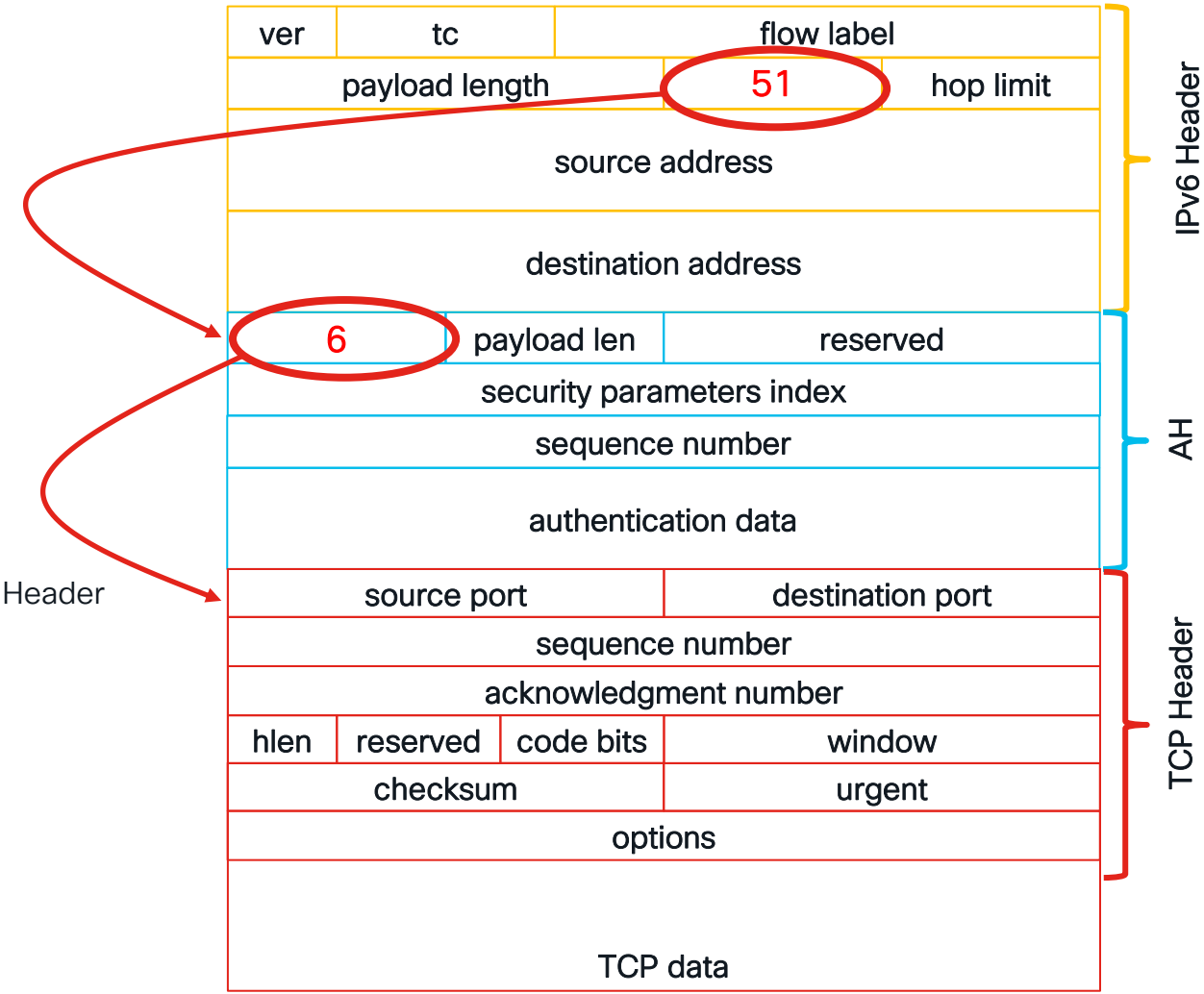
- IPv6 Header
- Destination IP address
- Next header field:
  - TCP, UDP, ICMP....
  - IPv4, IPv6, L2
  - IPv4, IPv6



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

SRv6

- IPv6 Header
- Destination IP address
- Next header field:
  - TCP, UDP, ICMP....
  - IPv4, IPv6, L2
  - Hop by Hop, Dest. Options, Fragmentation, Authentication Header ...



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

SRv6

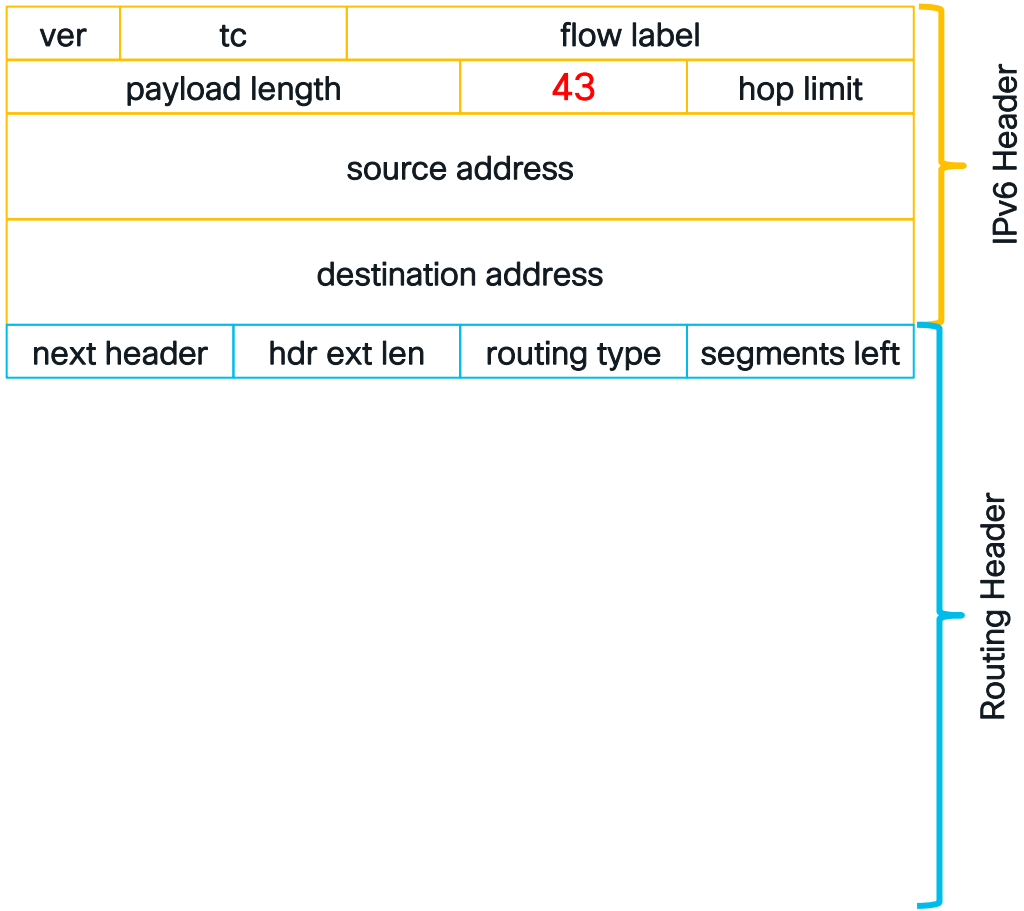
- IPv6 Header
- Destination IP address
- Next header field:
  - TCP, UDP, ICMP....
  - IPv4, IPv6, L2
  - Hop by Hop, Dest. Options, Fragmentation, Authentication Header ...
  - Routing header

    0 Source Route (deprecated)

    1 Nimrod (deprecated)

    2 Type 2 (RFC 6275)

    3 RPL (RFC 6554)



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

SRv6

- IPv6 Header
- Destination IP address
- Next header field:
  - TCP, UDP, ICMP....
  - IPv4, IPv6, L2
  - Hop by Hop, Dest. Options, Fragmentation, Authentication Header ...
  - Routing header

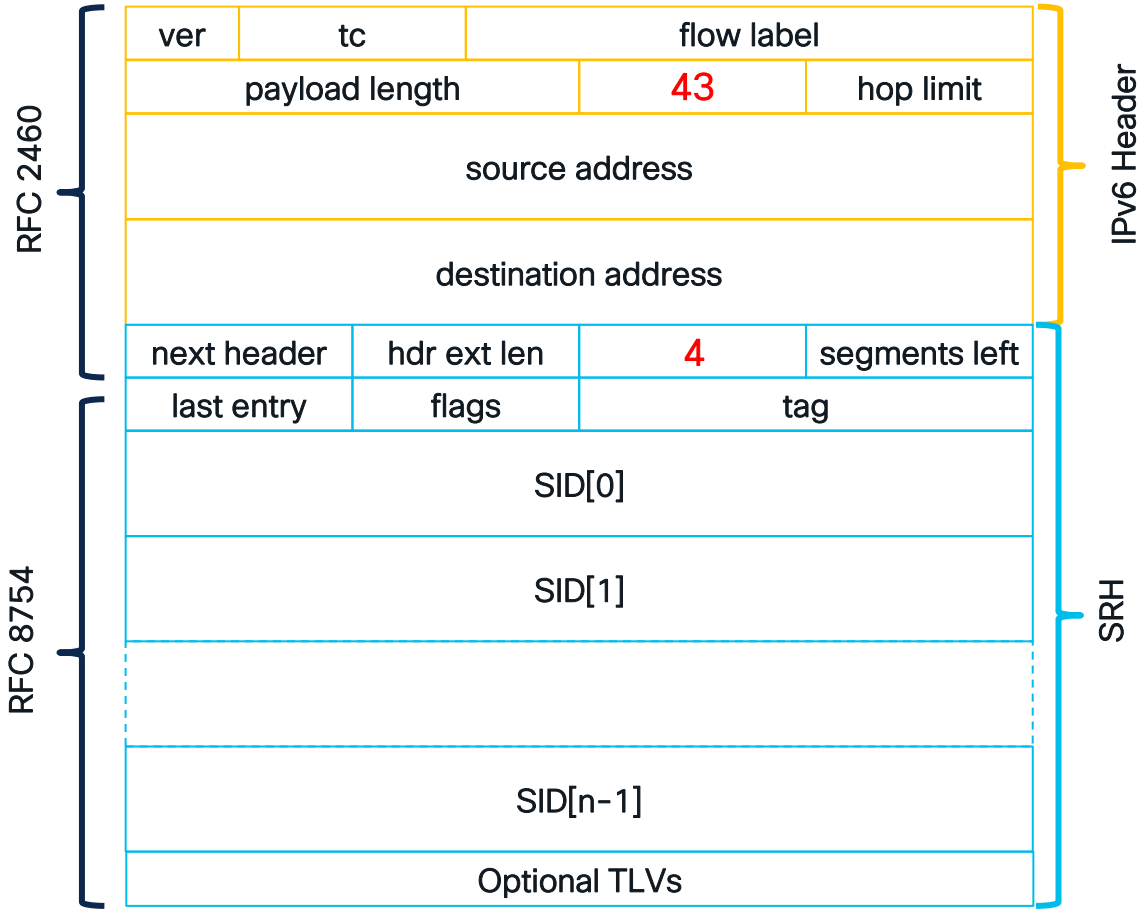
    0 Source Route (deprecated)

    1 Nimrod (deprecated)

    2 Type 2 (RFC 6275)

    3 RPL (RFC 6554)

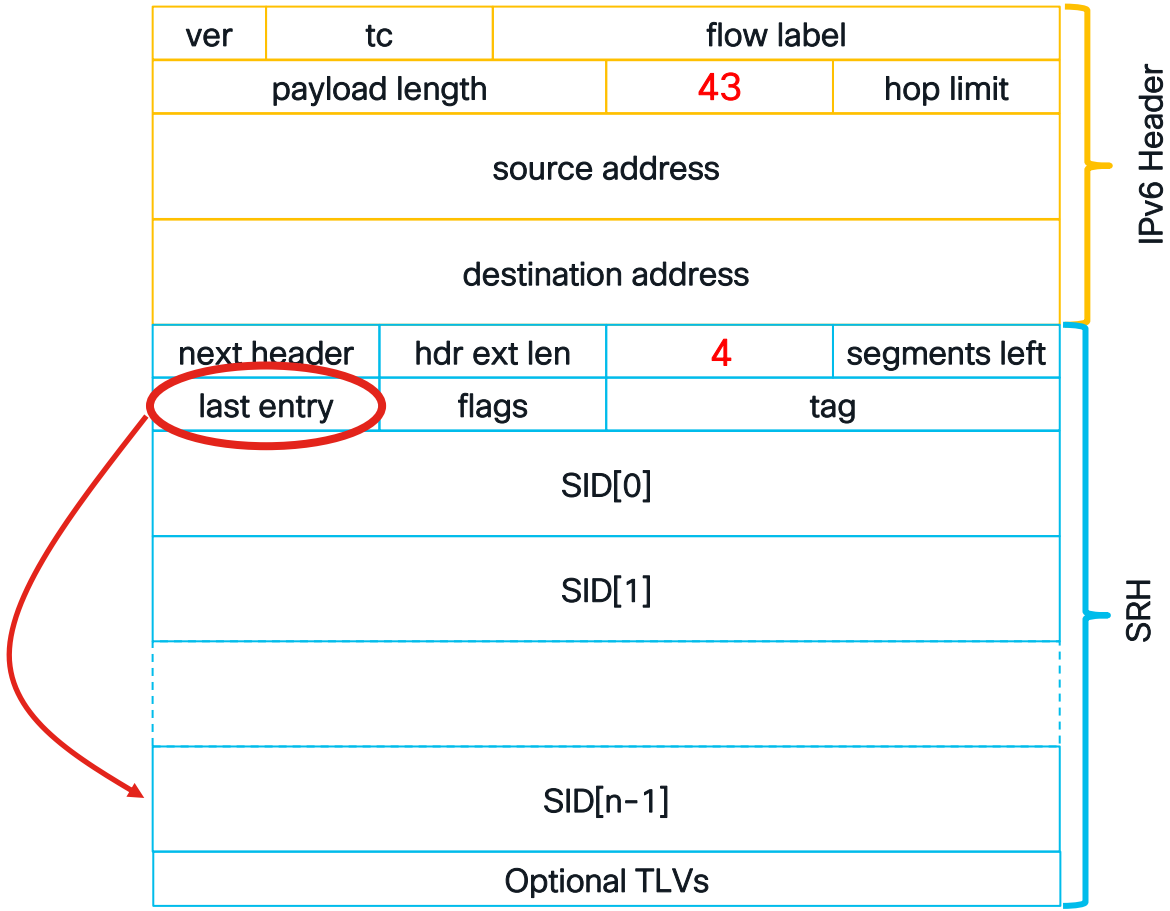
    4 SRH (RFC 8754)



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

SRH

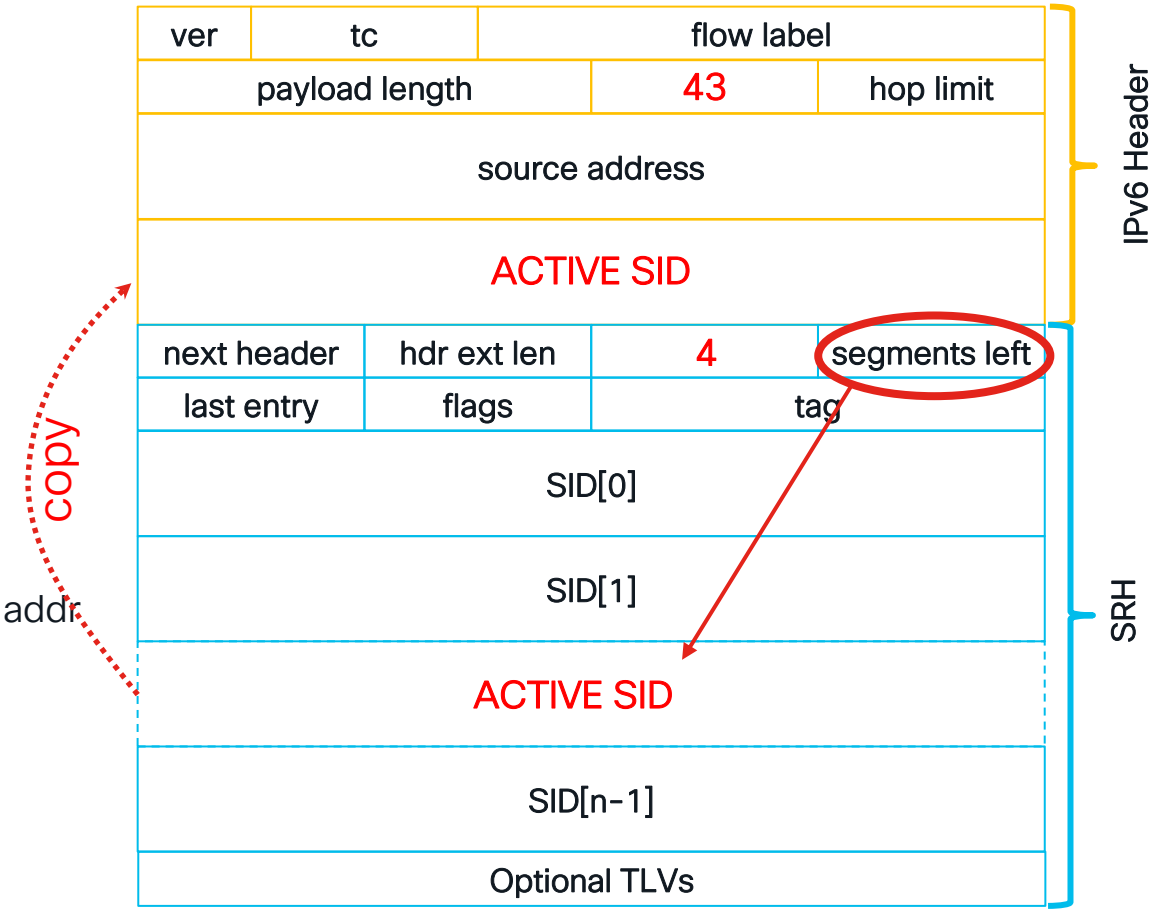
- Segment Routing Header
- First segment
  - Pointer to very first SID



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

SRH

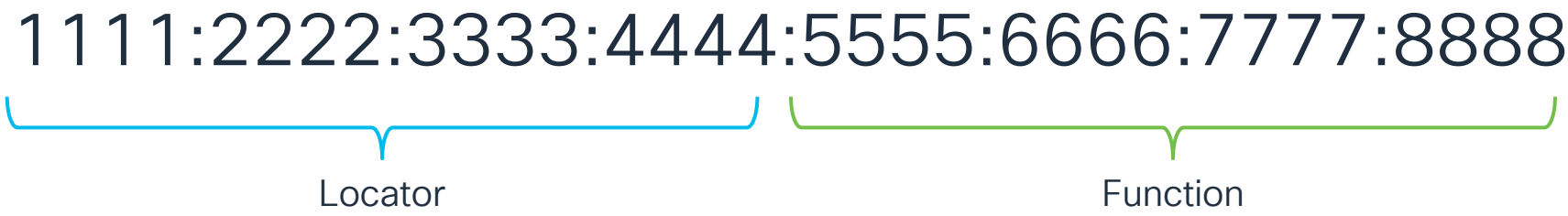
- Segment Routing Header
- First segment
  - Pointer to very first SID
- Segments left
  - Pointer to active SID
  - Active SID always in destination addr



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

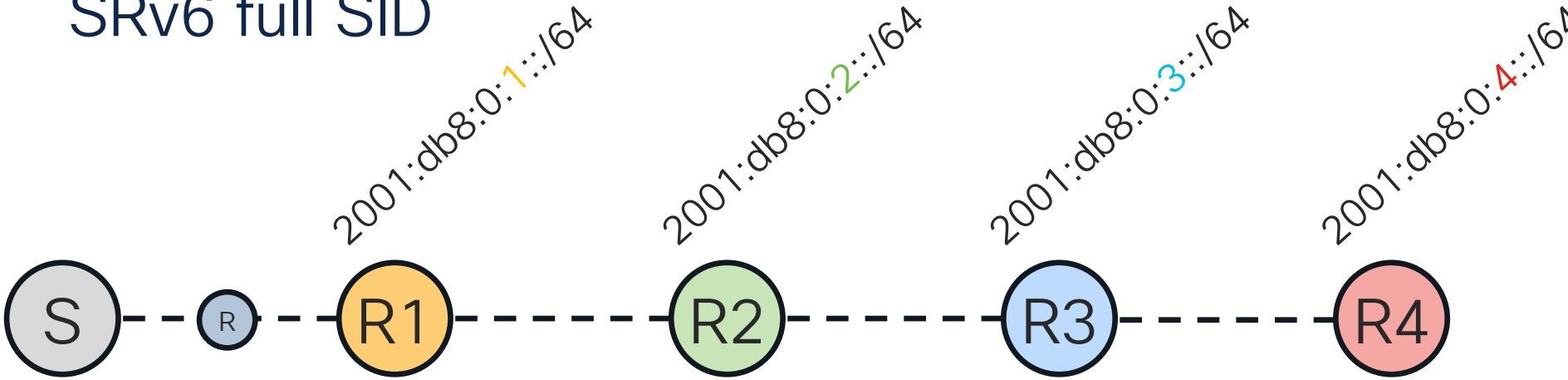
SID structure-locator

128 Bits Like IPv6 address but different semantics



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

SRv6 full SID



SA:2001::1
DA:2001:db8:0:1:1::
NH:RH

Type:4(SRH)
NH:IPv4|SL:3
Segment List:
[0]:2001:db8:0:4:eeee::
[1]:2001:db8:0:3:48::
[2]:2001:db8:0:2:1::
[3]:2001:db8:0:1:1::

SA:2001::1
DA:2001:db8:0:2:1::
NH:RH

Type:4(SRH)
NH:IPv4|SL:2
Segment List:
[0]:2001:db8:0:4:eeee::
[1]:2001:db8:0:3:48::
[2]:2001:db8:0:2:1::
[3]:2001:db8:0:1:1::

SA:2001::1
DA:2001:db8:0:3:48::
NH:RH

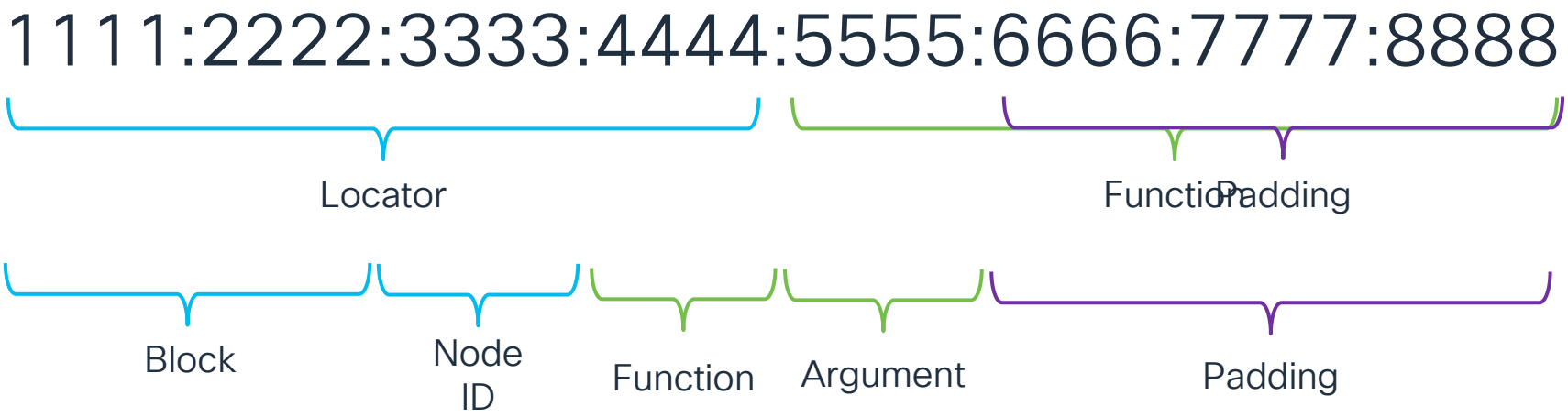
Type:4(SRH)
NH:IPv4|SL:1
Segment List:
[0]:2001:db8:0:4:eeee::
[1]:2001:db8:0:3:48::
[2]:2001:db8:0:2:1::
[3]:2001:db8:0:1:1::

SA:2001::1
DA:2001:db8:0:4:eeee::
NH:IPv4

© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

SID structure

128 Bits Like IPv6 address but different semantics



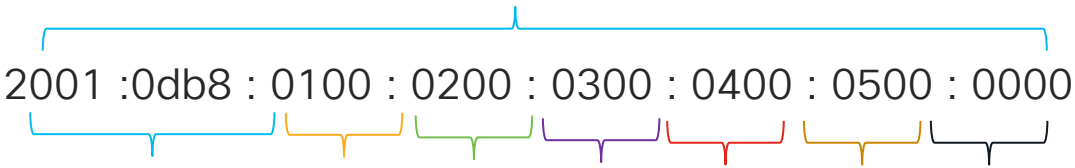
© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

SRv6 uSID format

: 0100 : =SRV6 uSID

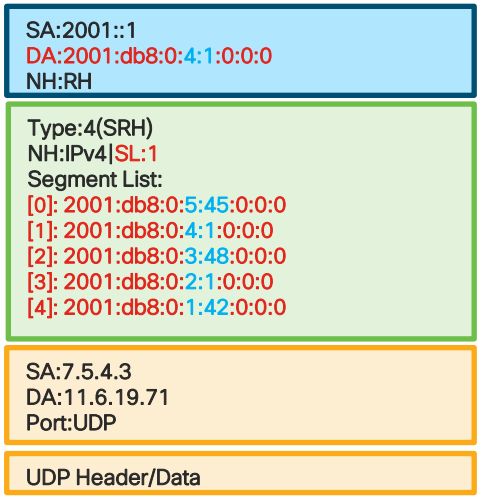
16 bits here, but can be anything

SRV6 uSID Container

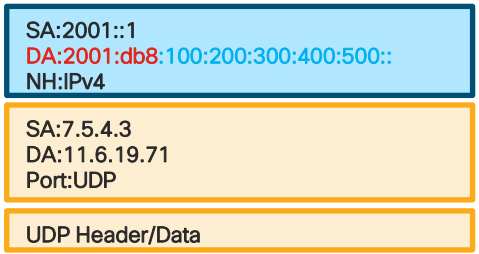


32 bits here,
but can be anything

SRV6 Encapsulation

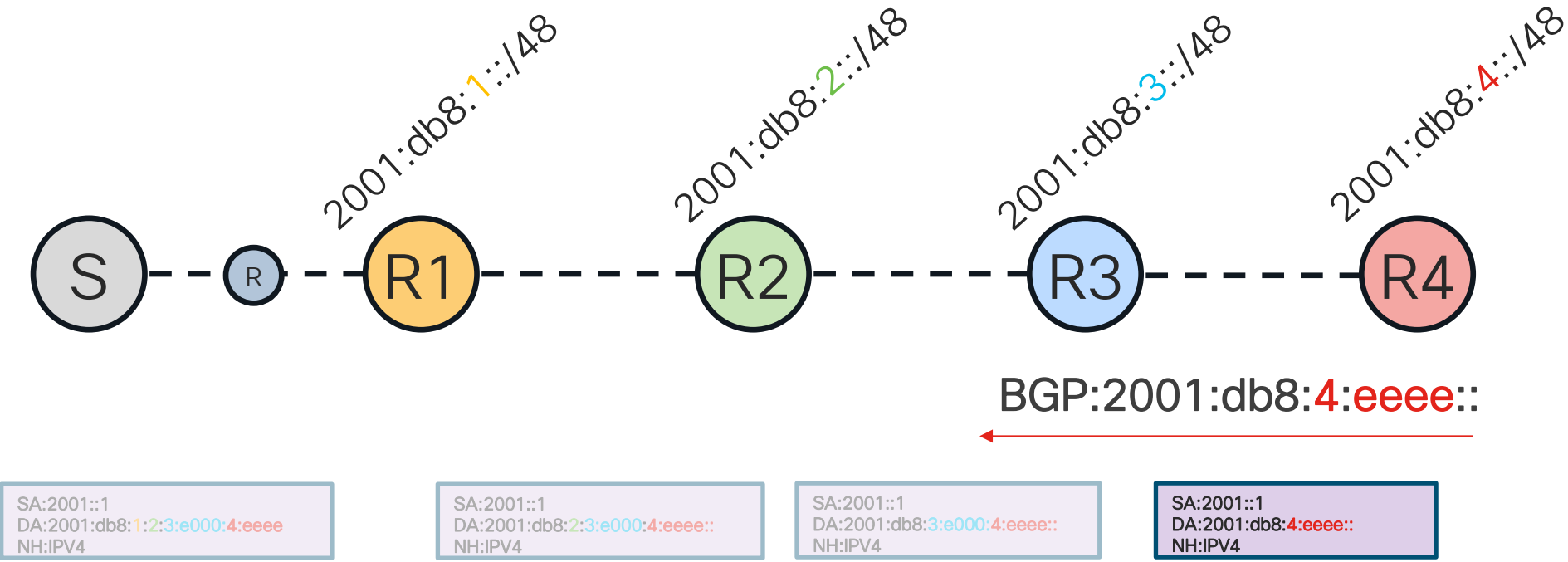


SRV6 uSID Encapsulation



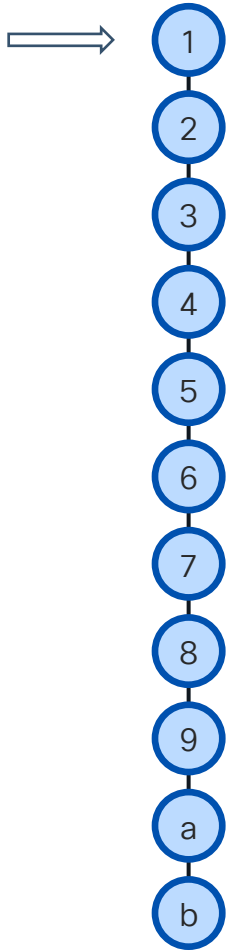
© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

SRv6 uSID F3216



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

SRv6 uSID more than 6 SIDs?



100->200->300->400->500->600->700->800->900->a00->b00

Container 1 2001 : 0db8 : 0100 : 0200 : 0300 : 0400 : 0500 : 0600

Container 2 2001 : 0db8 : 0700 : 0800 : 0900 : 0a00 : 0b00 : 0000

SA:2001::1
DA:2001:db8:100:200:300:400:500:600
DA:2001:db8:700:800:900:a00:b00:0
NH:IPv4

Type:4(SRH)
NH:IPv4| SL:0
Segment List:
[0]: 2001:db8:700:800:900:a00:b00::

SA:7.5.4.3
DA:11.6.19.71
Port:UDP

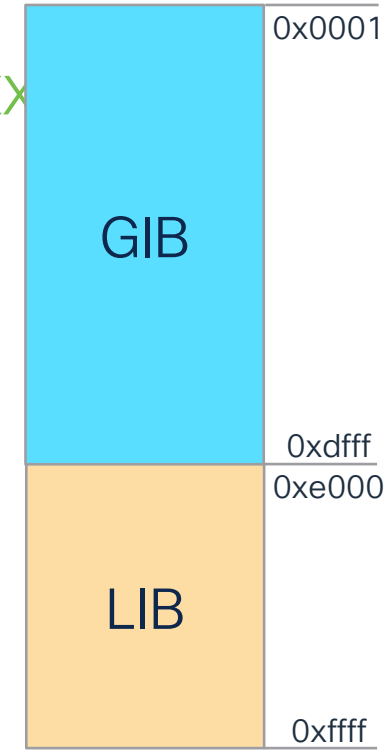
UDP Header/Data

Shift & Forward
END of Container
-> is there SRH?
Decrement SL
copy new SID (Container)
PSP

© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

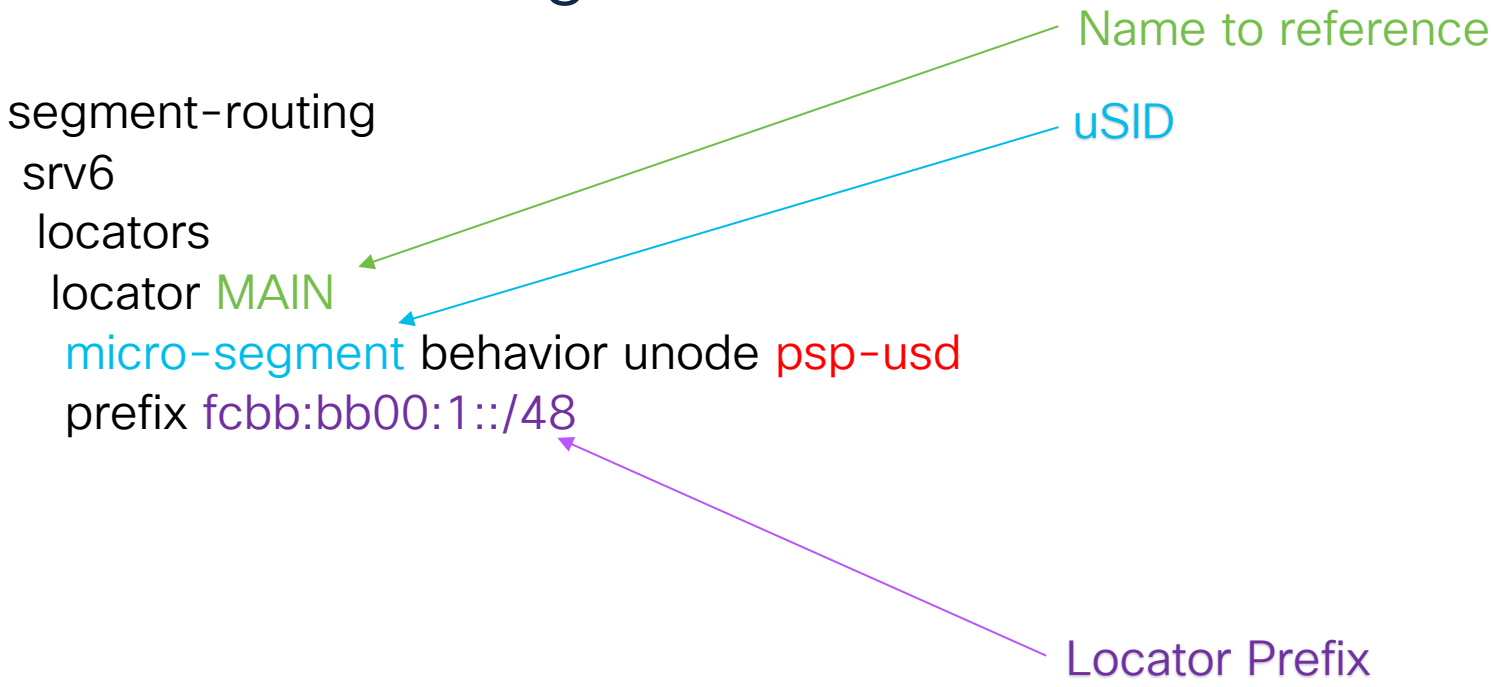
Sets, Global ID Block (GIB), Local ID Block (LIB)

- Within a Block, SIDs are allocated: FCBB:BB00:XXXX
- SID can be:
  - Global: shortest path to a node – globally unique
  - Local: a local function – not globally unique



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

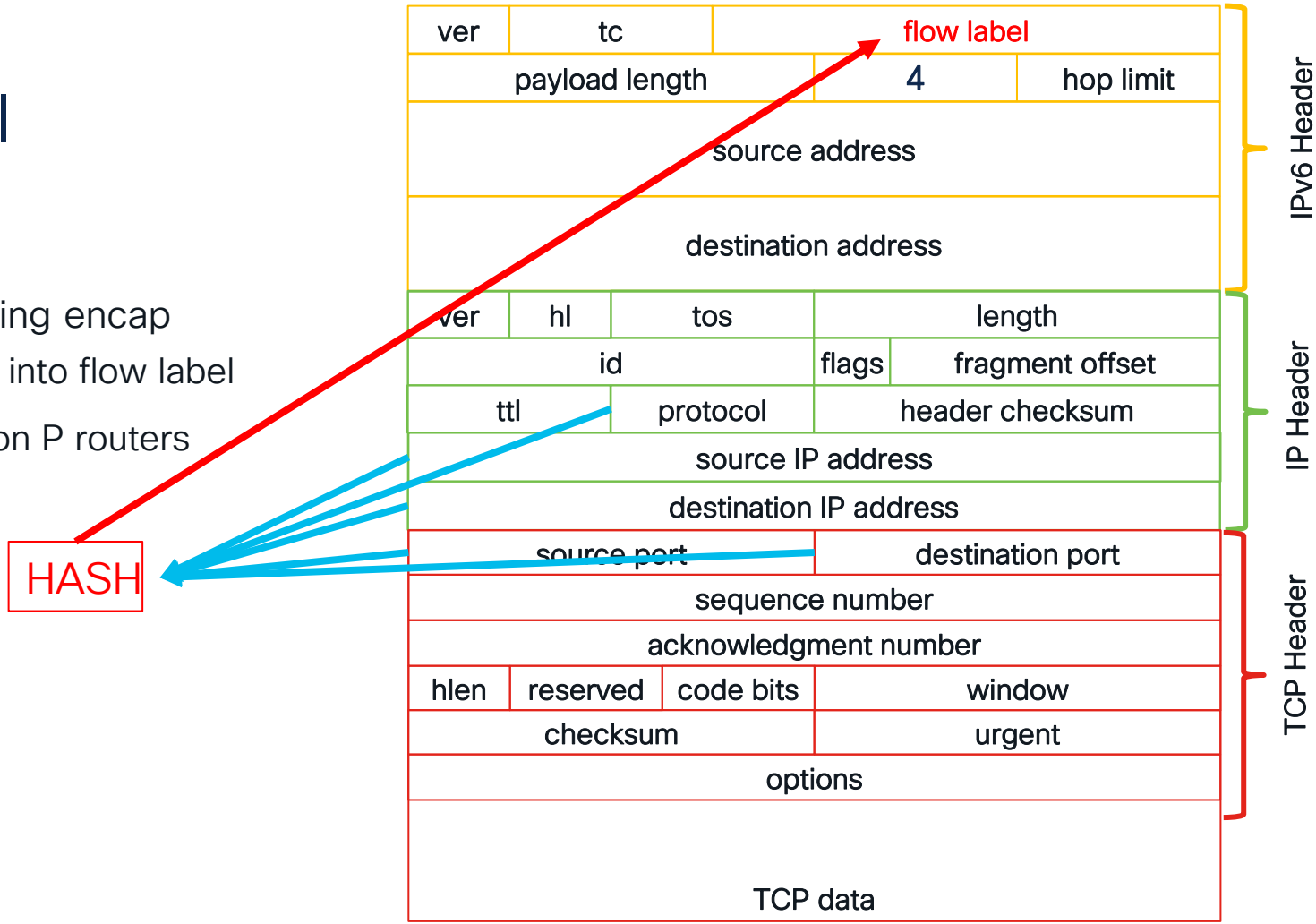
SRv6 uSID configuration



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

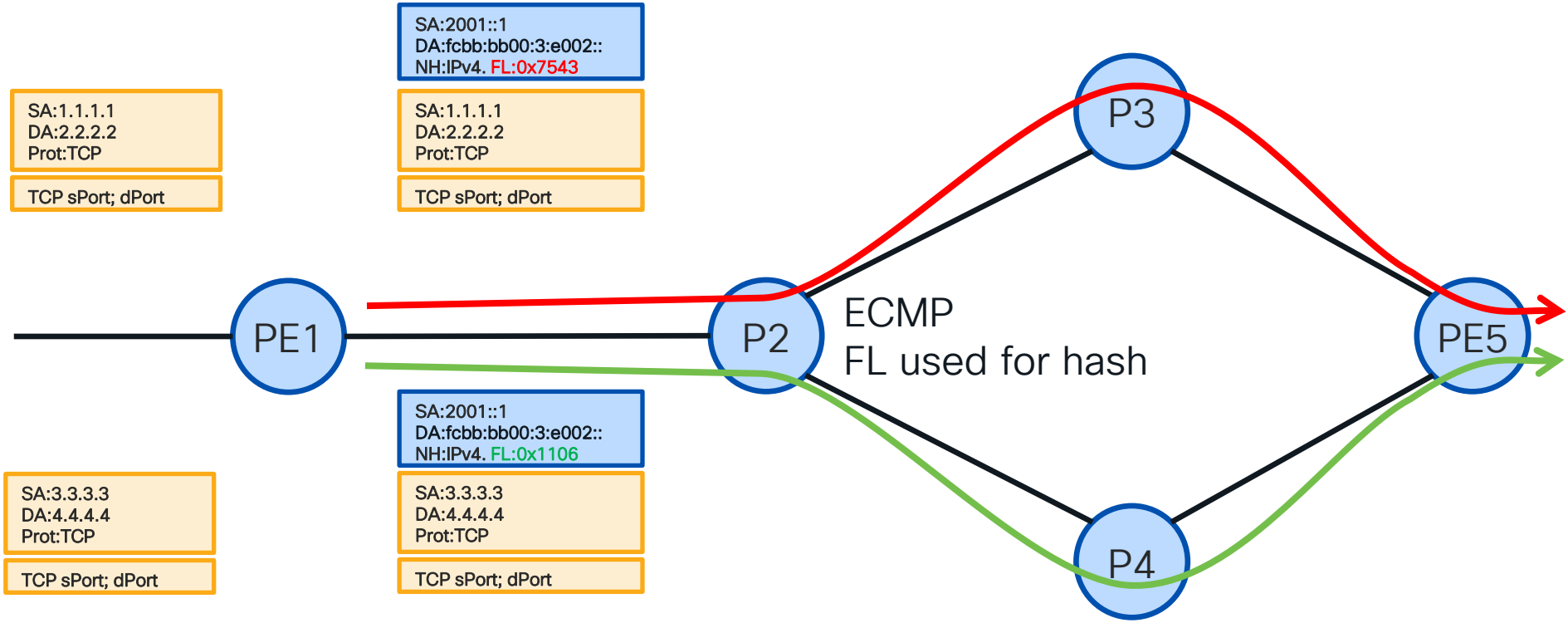
Flow label

- What for?
- Entropy encoding encap
  - 5 Tuple Hash into flow label
- Used for Hash on P routers



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

Flow label



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

SRv6 Network Programming

cisco Live!

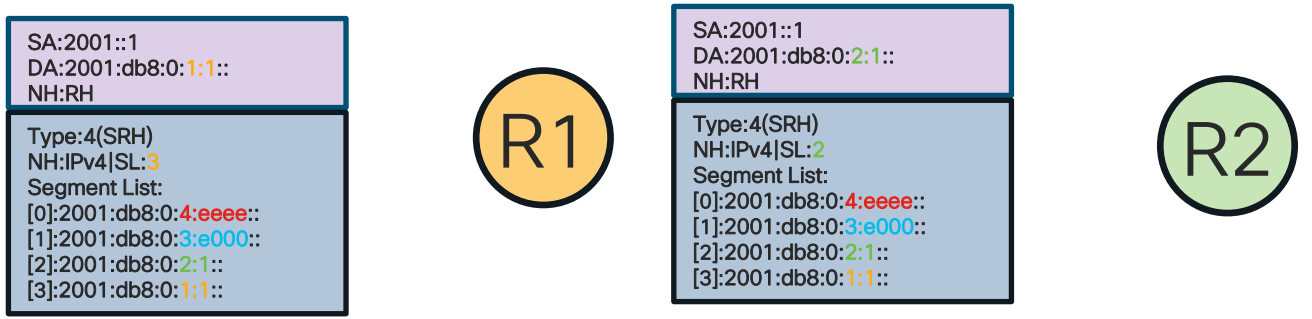
SRv6 functions: RFC 8986

Codename		Behavior	
End	uN	Endpoint	[Node SID]
End.X	uA	Endpoint with Layer-3 cross-connect	[Adj SID]
End.B6.Insert	uB6.Insert	Endpoint bound to an SRv6 policy	[BSID]
End.B6.Encap	uB6.Encaps	Endpoint bound to an SRv6 encapsulation policy	[BSID]
End.DX6	uDX6	Endpoint with decapsulation and IPv6 cross-connect	[L3VPN Per-CE]
End.DX4	uDX4	Endpoint with decapsulation and IPv4 cross-connect	[L3VPN Per-CE]
End.DT6	uDT6	Endpoint with decapsulation and specific IPv6 table lookup	[L3VPN Per-VRF]
End.DT4	uDT4	Endpoint with decapsulation and specific IPv4 table lookup	[L3VPN Per-VRF]
End.DX2	uDX2	Endpoint with decapsulation and L2 cross-connect	[E-LINE]
End.DT2U/M	uDT2U/M	Endpoint with decapsulation and L2 unicast lookup / flooding	[E-LAN]
End.DTM	uDTM	Endpoint with decapsulation and MPLS table lookup	[Interworking]
H.Insert / H.Encaps		Headend with Insertion / Encapsulation of / into an SRv6 policy	[TiLFA]
H. Encaps.L2		H.Encaps Applied to Received L2 Frames	[L2 Port Mode]
H.Encaps.M		H.Encaps Applied to MPLS Label Stack	[Interworking]

© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

END- default endpoint (Node SID)

- *Decrement SL*
- *Copy active SID*
- *Forward*



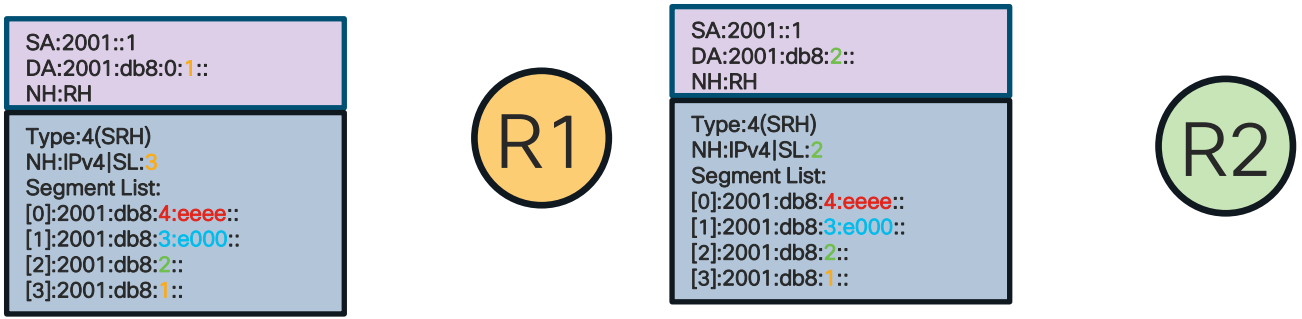
- Different flavors:
  - End
  - End with PSP
  - End with USP
  - End with PSP & USP
  - End with USD
  - End with PSP & USD
  - End with USP & USD
  - End with PSP, USP & USD

- End with NEXT-ONLY-CSID
- End with NEXT-CSID
- End with NEXT-CSID & PSP
- End with NEXT-CSID & USP
- End with NEXT-CSID, PSP & USP
- End with NEXT-CSID & USD
- End with NEXT-CSID, PSP & USD
- End with NEXT-CSID, USP & USD
- End with NEXT-CSID, PSP, USP & USD

© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

uN=END with next – default endpoint (Node SID)

- *Decrement SL*
- *Copy active SID*
- *Forward*

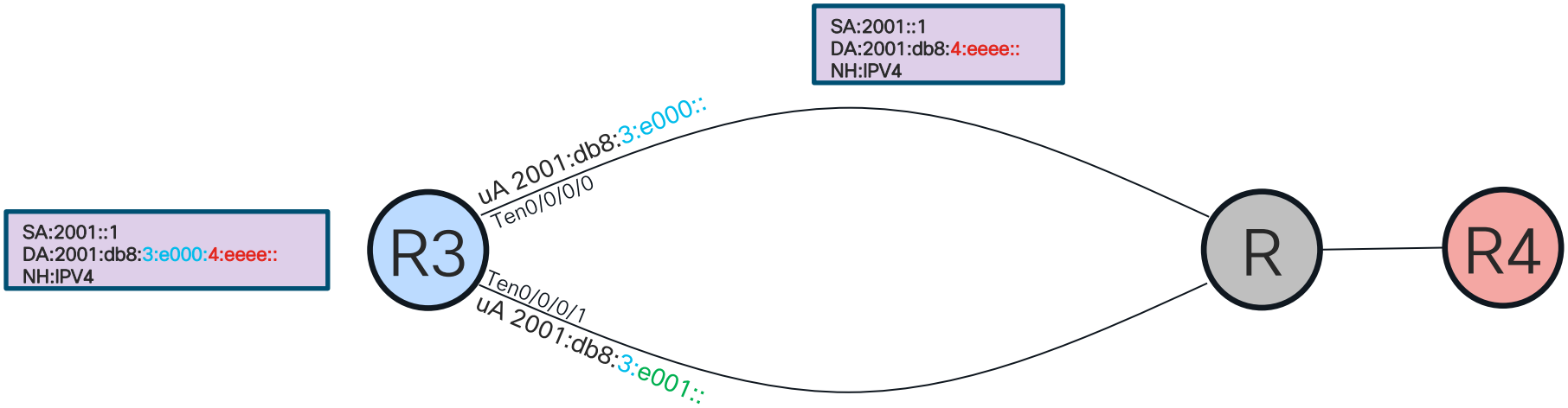


Better way:

- *Shift & forward*

© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

uA=END.X with next – (Adjacency SID)



- *Shift & forward to **SPECIFIC INTERFACE***

© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

uDX4=END.DX4, uDX6=END.DX6, uDX2=END.DX2 Endpoint with **D**ecapsulation and **X**connect

- *Decapsulate and forward to **SPECIFIC INTERFACE***
- ***Same as per CE Label Allocation***
- *Must be last function in SID list*

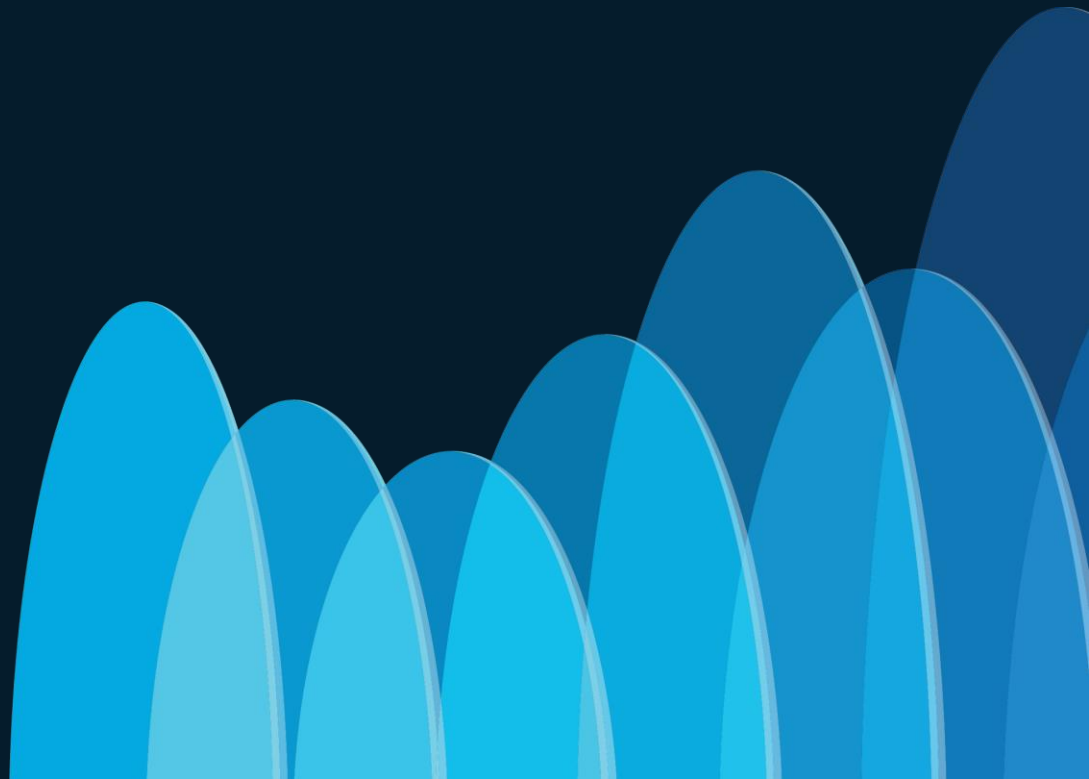
© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

uDT4=END.DT4, uDT6=END.DT6
Endpoint with **D**ecapsulation and **T**able Lookup

- *Decapsulate and table Lookup* ***(VRF)***
- ***Same as per VRF Label Allocation (aggregate label)***
- *Must be last function in SID list*

© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

SRv6 uSID ISIS



ISIS for SRv6

LSP (Link State Packet):

TLVs:

Hostname: r2

Interfaces: Hu0/0/0/0 uA:fcbb:0:2:e001::

Structure: BL=32;NL=16;FL=16;AL=0

Hu0/0/0/1 uA:fcbb:0:2:e002::

Structure: BL=32;NL=16;FL=16;AL=0

Lo0

Neighbors: r1

r3

IP addresses: fcbb:0:2::1/128

2001:12::2/64

Locator: fcbb:0:2::/48

uN:fcbb:0:2::

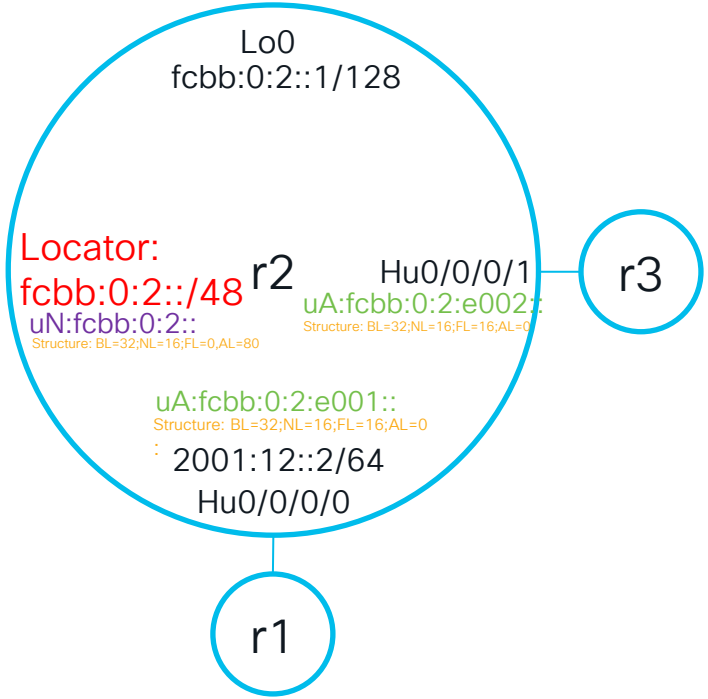
Structure: BL=32;NL=16;FL=0,AL=80

Capabilities: Algorithms .....

SIDs can insert

SIDs can decap

.....



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

ISIS LSP Example

```
IS-IS 1 (Level-2) Link State Database
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime/Rcvd  ATT/P/OL
r2.00-00              0x00000009   0x4f06        1145 /1200         0/0/0
  Area Address:   49
  NLPID:          0x8e
  Hostname:       r1
  IPv6 Address:   2001::2
  Metric: 10         MT (IPv6 Unicast) IPv6 fcbb:bb00:2::1/128
    Prefix Attribute Flags: X:0 R:0 N:1 E:0 A:0
  Metric: 1          MT (IPv6 Unicast) IPv6 fcbb:bb00:2::/48
    Prefix Attribute Flags: X:0 R:0 N:0 E:0 A:0
  MT:             IPv6 Unicast                         0/0/0
  SRv6 Locator:   MT (IPv6 Unicast) fcbb:bb00:2::/48 D:0 Metric: 0 Algorithm: 0
    Prefix Attribute Flags: X:0 R:0 N:0 E:0 A:0
    END SID: fcbb:bb00:2:: uN (PSP/USD)
      SID Structure:
        Block Length: 32, Node-ID Length: 16, Func-Length: 0, Args-Length: 0
  Router Cap:     0.0.0.0 D:0 S:0
    IPv6 Router ID: 2001::2
    SR Algorithm:
      Algorithm: 0
      Algorithm: 1
    SRv6: O:0
    Node Maximum SID Depth:
      SRH Max SL:       3
      SRH Max End Pop:  3
      SRH Max T.insert: 3
      SRH Max T.encaps: 4
      SRH Max End D:    4
  Metric: 10         MT (IPv6 Unicast) IS-Extended r1.00
    Local Interface ID: 6, Remote Interface ID: 6
    Interface IPv6 Address: 2001:12::2
    Neighbor IPv6 Address: 2001:12::1
    END.X SID: fcbb:bb00:2:e001:: B:0 S:0 P:0 uA (PSP/USD) Alg:0
      SID Structure:
        Block Length: 32, Node-ID Length: 16, Func-Length: 16, Args-Length: 0
Total Level-2 LSP count: 1     Local Level-2 LSP count: 0
```

Locator
Capabilities
END
END.X
SID Structure

© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

SRv6 ISIS configuration

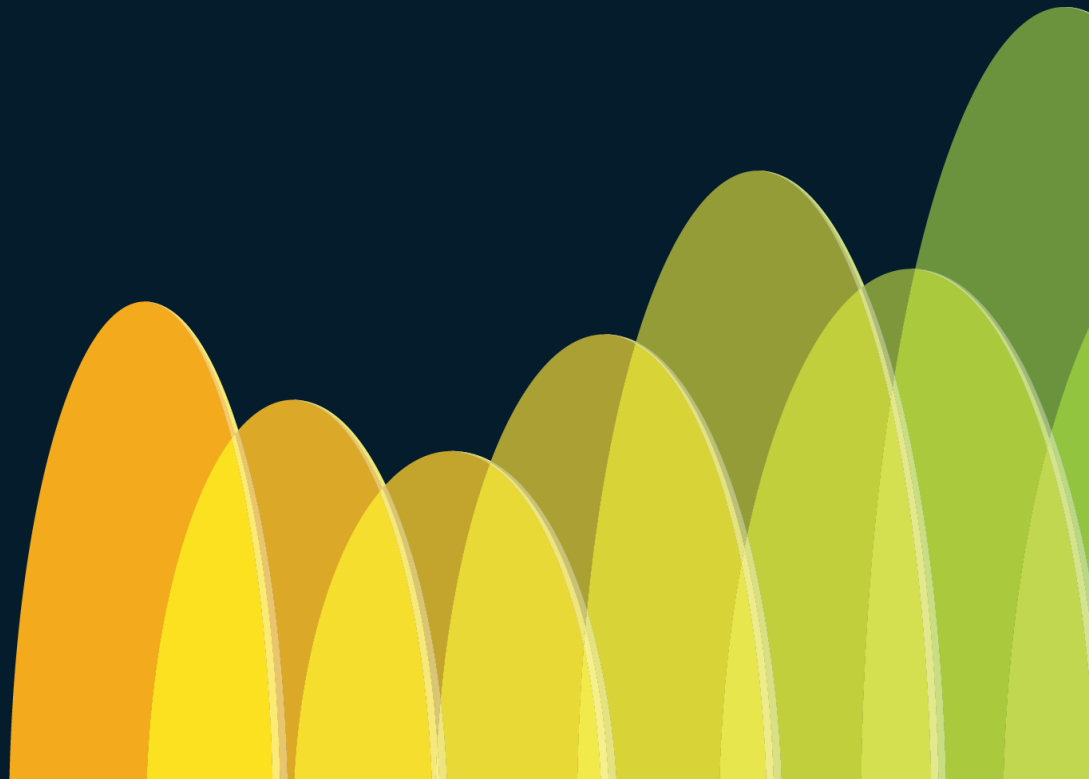
```
router isis 1
 address-family ipv6 unicast
  segment-routing srv6
   locator MAIN
```

This will result in:

- Locator is advertised
- uN function is advertised
- uA for each ISIS interface is allocated and advertised

© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

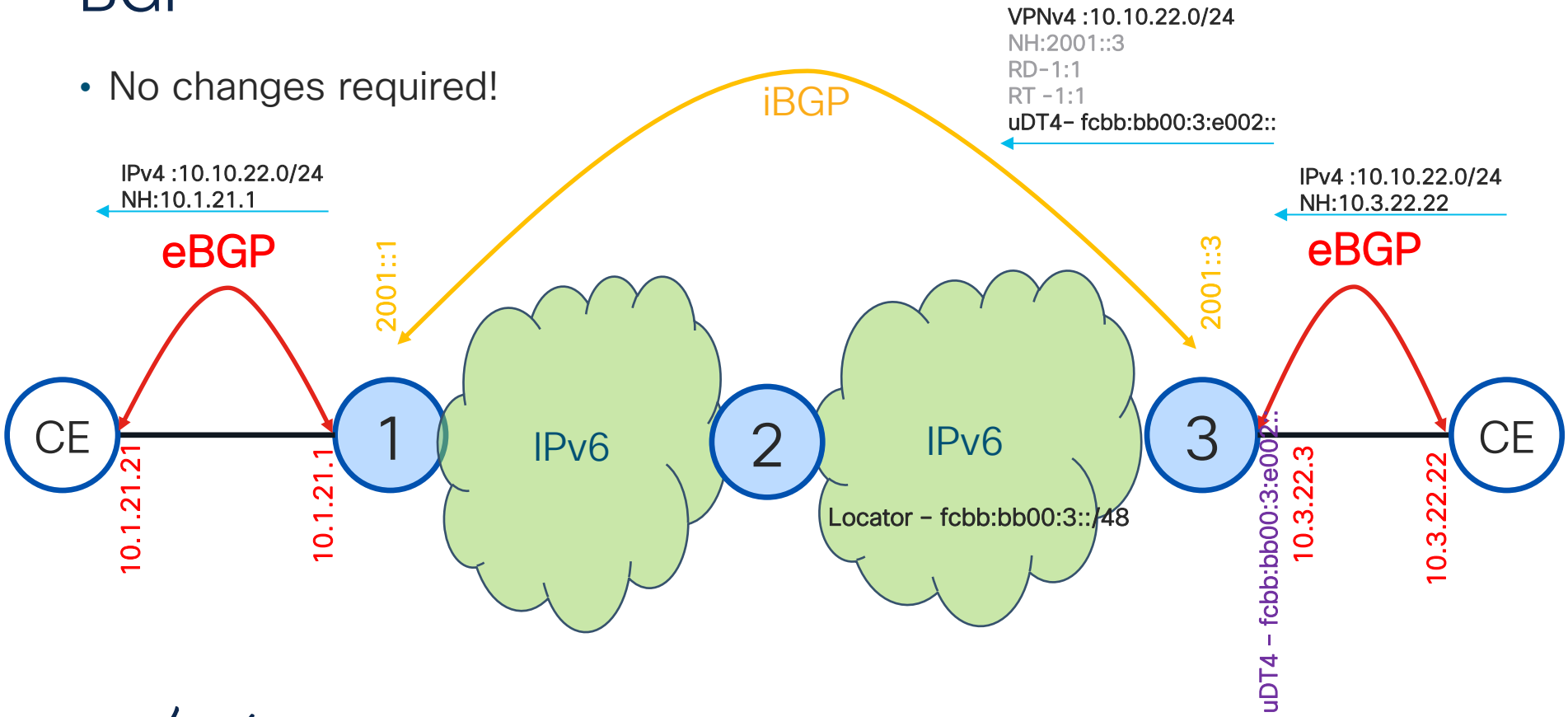
SRv6 uSID BGP



cisco Live!

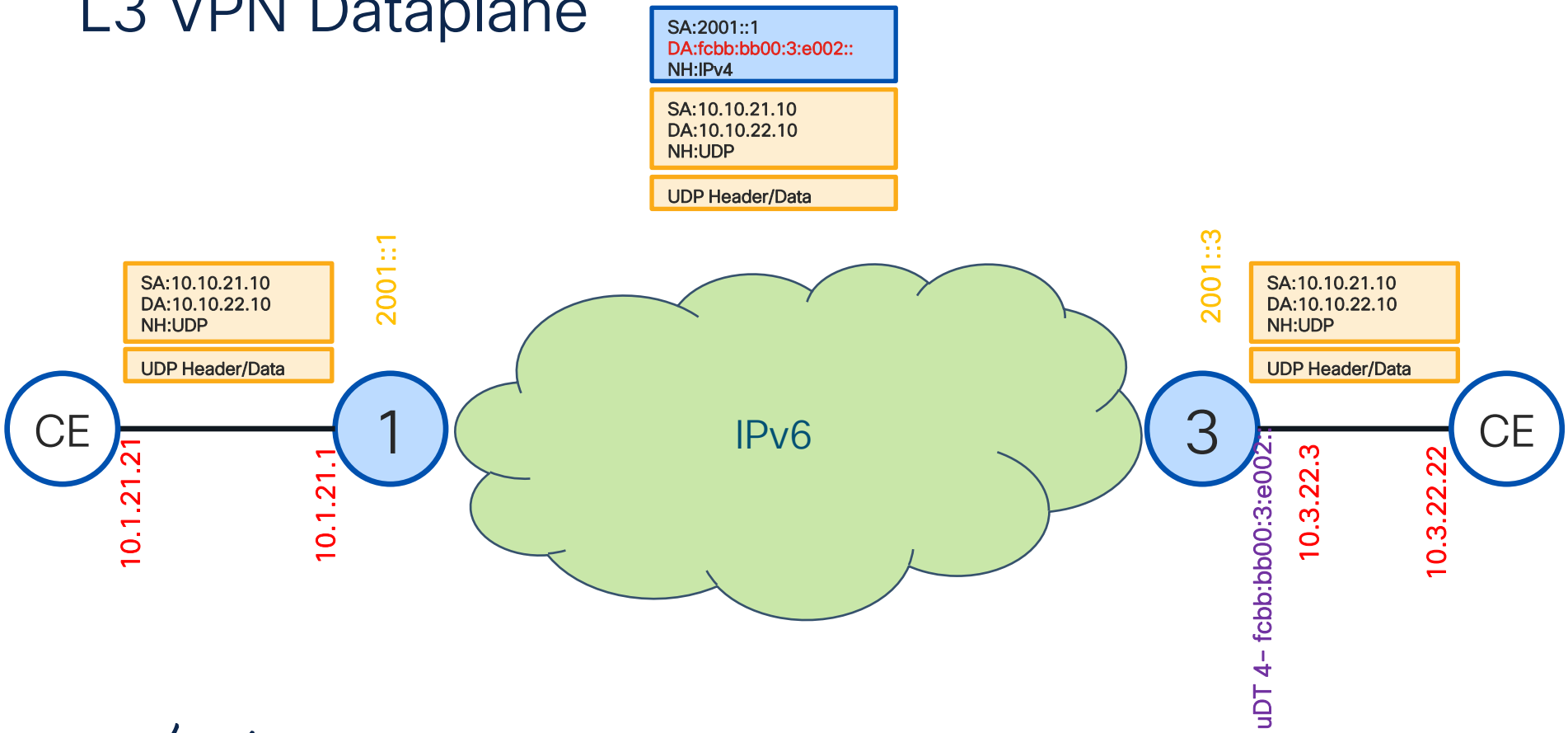
BGP

- No changes required!



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

L3 VPN Dataplane



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

SRv6 L3 VPN configuration

```
router bgp 1
 address-family vpnv4 unicast
 vrf BestEffort
  rd 1:1
  address-family ipv4 unicast
   segment-routing srv6
    locator MAIN
    alloc mode per-vrf
```

Name of the Locator

Single DT function is allocated per VRF and AF

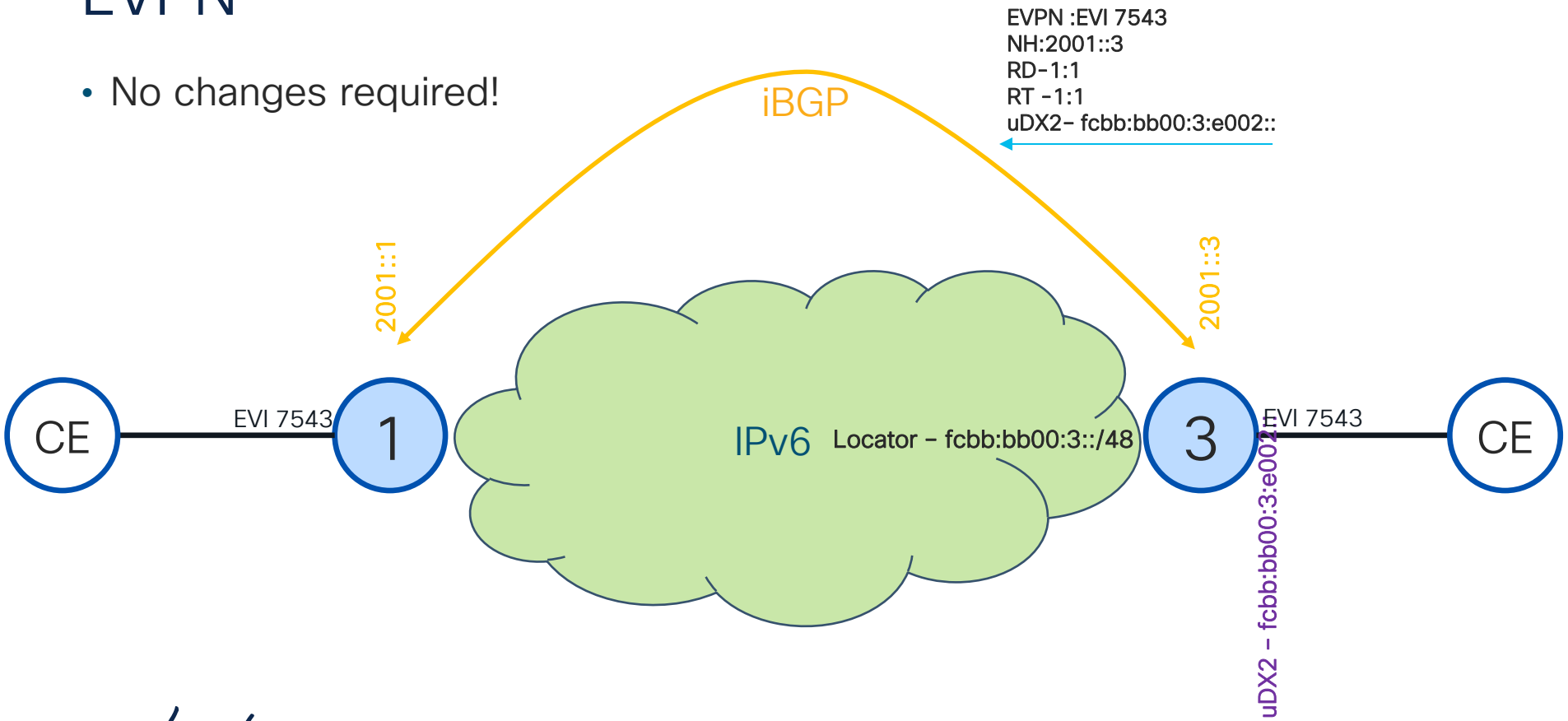
This will result in:

- uDT4 function is allocated
- All prefixes are advertised with uDT4 function

© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

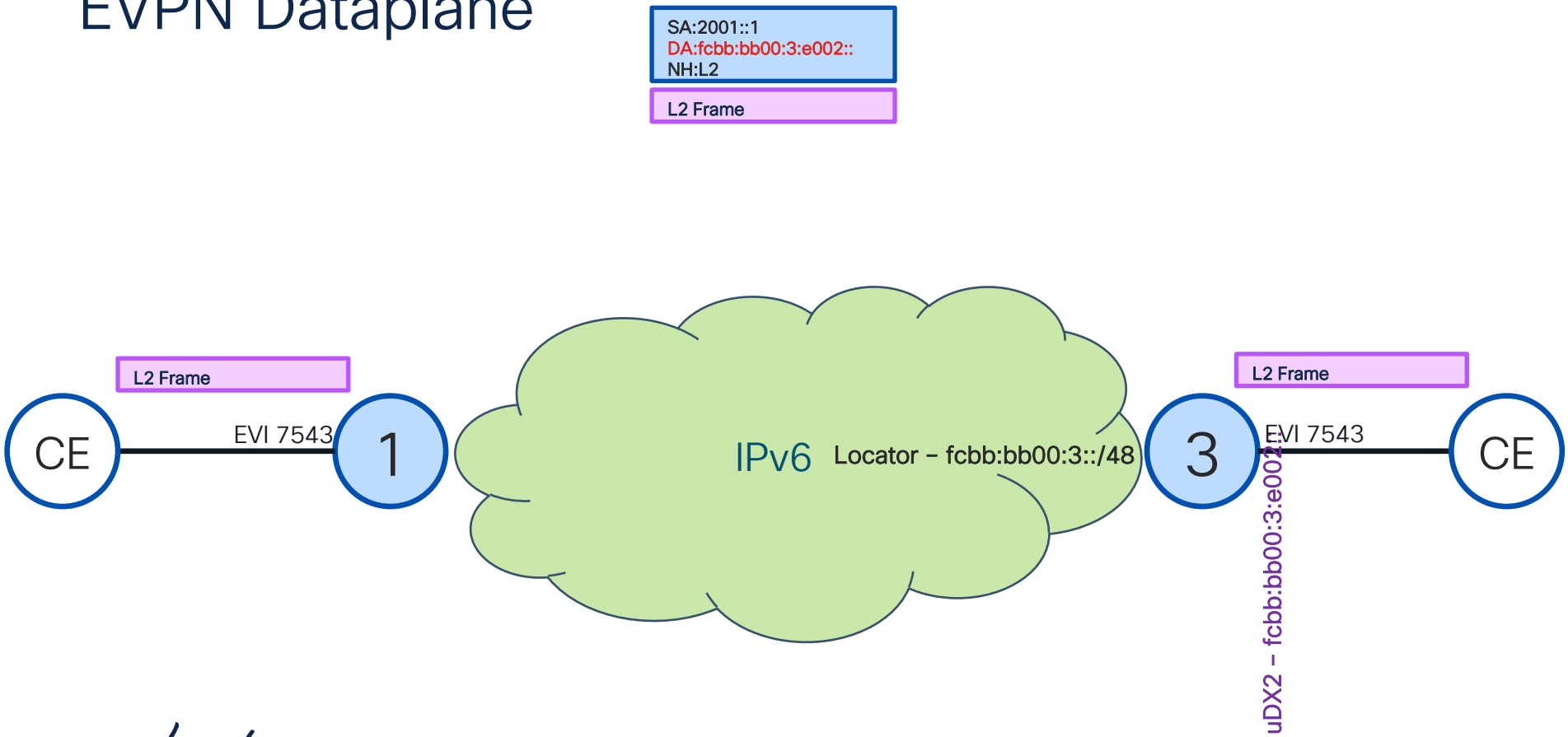
EVPN

- No changes required!



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

EVPN Dataplane



© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

SRv6 L2 VPWS

```
interface TenGigE0/0/0/0.7543 l2transport
 encapsulation dot1q 7543
 rewrite ingress tag pop 1 symmetric

l2vpn
 xconnect group P2P
  p2p 13-14
   interface TenGigE0/0/0/0.7543
   neighbor evpn evi 7543 service 7543 segment-routing srv6

evpn
 evi 7543 segment-routing srv6
  locator MAIN
 segment-routing srv6
 !
```

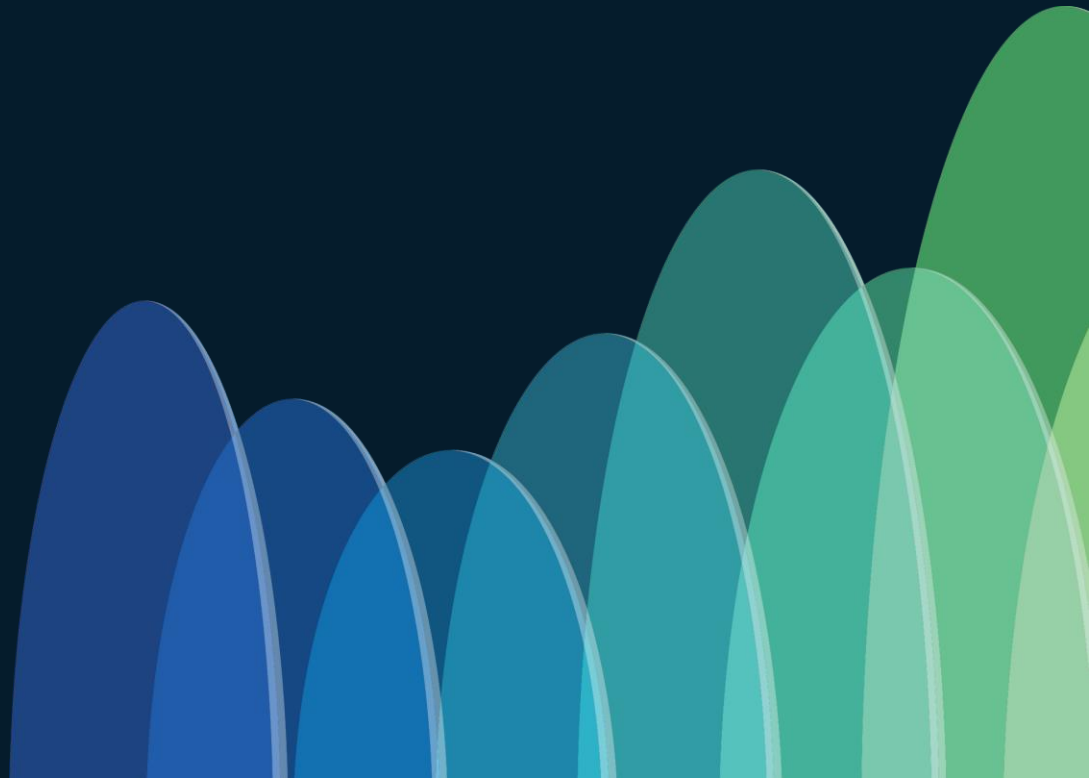
Name of the Locator

This will result in:

- uDX2 function is allocated per EVI
- EVI is advertised with uDX2 function

© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

Conclusion



Conclusion

- SRv6 is fully ready for brownfield deployments
- SRv6 uSID is the only reasonable format
- SRv6 uSID supported across cisco platform
- SRv6 uSID supported across vendors

© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

cisco Live!

Keynote Deep Dives

Wednesday
10:30am –11:30am

Experiences Amplified: How AI Can Fuel Better Employee and Customer Experiences

Level 1
Room 106

Smart, Secure, Seamless: Transforming Experiences with Next-Generation Networking

Level 2
Room 204

Harness a Bold New Era: Transform Data Centre and Service Provider Connectivity

Level 2
Room 203

Securing User to Application and Everything in Between

Level 2
Melbourne Room 2

Unlocking Digital Resilience through Unified Observability

The HUB
Centre Stage

Complete Your Session Evaluations

Complete a minimum of 4 session surveys and the Overall Event Survey to claim a **Cisco Live T-Shirt**.

Complete your surveys in the **Cisco Live mobile app**.

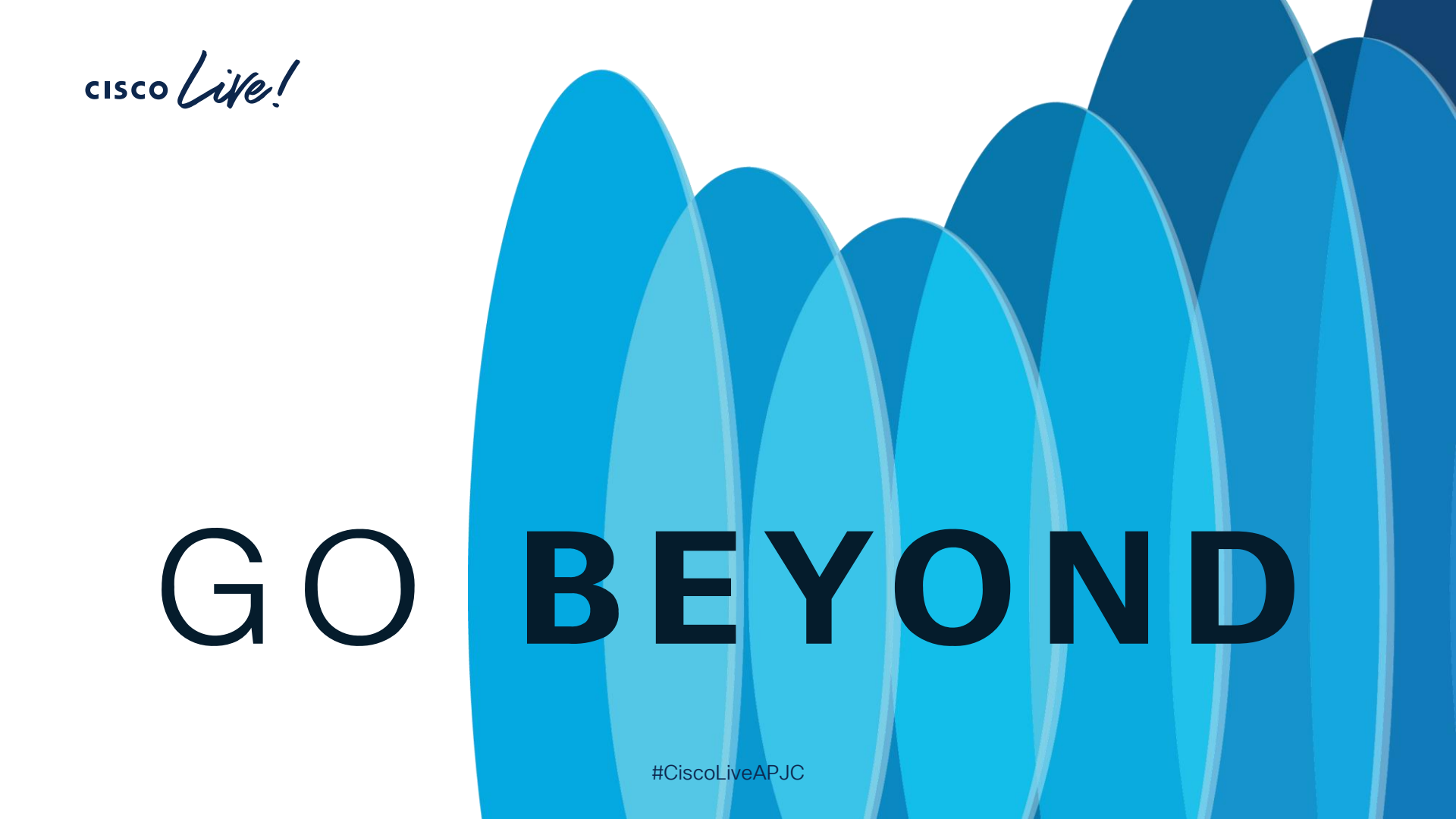
© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

Continue your education

- Visit the Cisco Stand for related demos
- Book your one-on-one Meet the Expert meeting
- Attend the interactive education with DevNet, Capture the Flag, and Walk-in Labs
- Visit the On-Demand Library for more sessions at www.CiscoLive.com/on-demand

© 2024 Cisco and/or its affiliates. All rights reserved. Cisco Public Cisco Confidential

cisco
Thank you
cisco Live!
#CiscoLiveAPJC


cisco Live!
GO BEYOND
#CiscoLiveAPJC